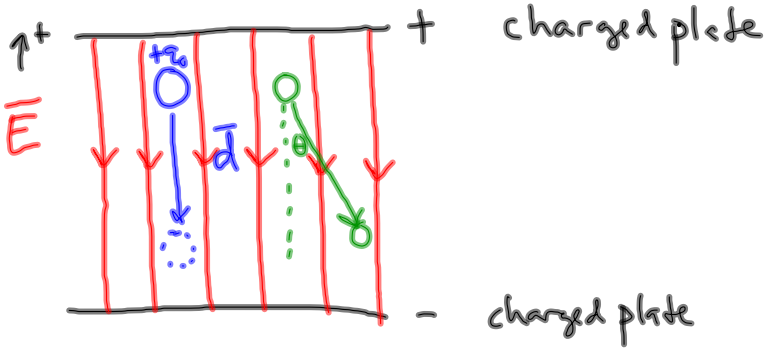
HW: p. 715: 3, 5, 10

p. 716: 13, 15

• Electric Potential Energy



$$\Delta U_e = -q_0 \vec{E} \cdot \vec{d}$$

$$= -q_0 E d \cos\theta$$

• Electric Potential Difference

(Potential, Potential Difference, Voltage)

$$\Delta V = \frac{U_e}{q_0} = \frac{-q_0 \vec{E} \cdot \vec{d}}{q_0} = -\vec{E} \cdot \vec{d}$$

↳ electric potential

- Work needed to move a charge

$$W = q\Delta V$$

- Units: $1\frac{N \cdot m}{C} = 1\,J/C \equiv 1\,V$

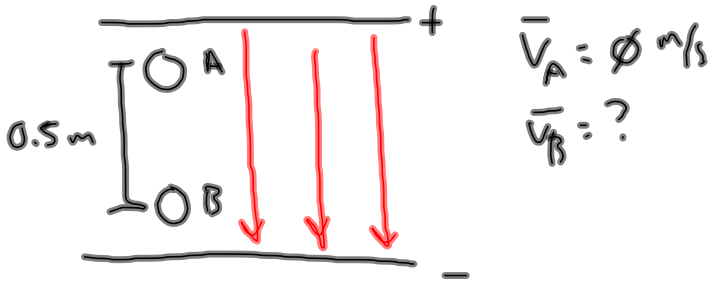
Volt

- We can also write N/C as V/m

A proton is released from rest at point A in a uniform electric field that has a magnitude of 8.0E4 V/m. The proton undergoes a displacement of 0.50 m to point B in the direction of the electric field. Find the speed of the proton after completing the 0.50 m displacement.

$q_p = 1.6E-19\,C$

$m_p = 1.67E-27\,kg$



$\bar{V}_A = 0\ m/s$

$\bar{V}_B = ?$

$$\Delta V = -Ed = -(8.0E4\ V/m)(.5\ m)$$

$$= -4E4\ V$$

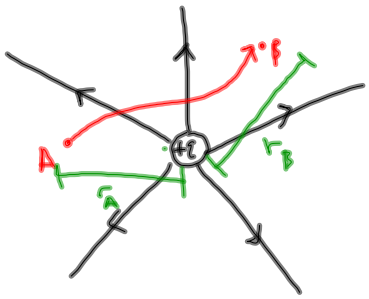
$$\Delta K + \Delta U = 0 \qquad \Delta U = q_p \Delta V$$

$$\left(\frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2\right) + q\Delta V = 0$$

$$v_B = \sqrt{\frac{-2q_p\Delta V}{m_p}}$$

$$= 2.8E6\ m/s$$

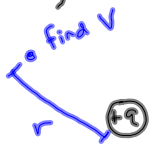
- Electric Potential for a Point Charge



$$V_B - V_A = kq\left[\frac{1}{r_B} - \frac{1}{r_A}\right]$$

- if $V = \emptyset V$ at $r = \infty$, then

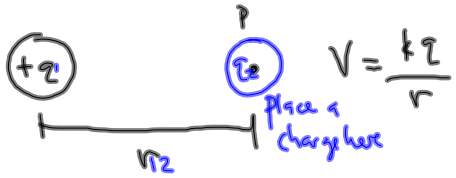
$$V = \frac{kq}{r}$$



- for a group of point charges

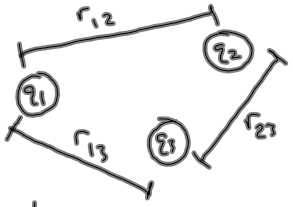
$$V = k\left(\frac{q_1}{r_1} + \frac{q_2}{r_2} + \ldots\right)$$

- Electric Potential Energy of point charge



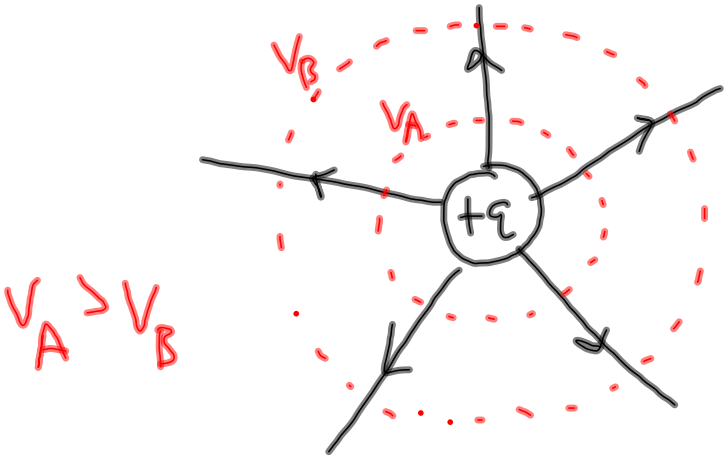
$$U = \frac{kq_1q_2}{r_{12}}$$

- How much energy will it take (or work)?



$$U_e = \frac{kq_1q_2}{r_{12}} + \left(\frac{kq_1q_3}{r_{13}} + \frac{kq_2q_3}{r_{23}}\right)$$

- Equipotentials
  - places in a configuration of charge where potential is equal



- Charge for a conducting sphere